Remarks

Applicant respectfully requests reconsideration of this application. Claims 1-9 and 11 are pending. Claims 10 and 12-20 have been canceled as being drawn to a non-elected invention. Applicant affirms the provisional election previously made without traverse.

Claims 1-9 and 11 have been amended to correct minor informalities in the claim language, such as deleting extraneous language and correcting clerical errors. Claim 2 was amended to change the nature of the dependent limitation. New claims 21-25 have been added to the application. No claims have been allowed. The first paragraph of specification has also been amended to update the information recited therein.

Art Rejections - 35 U.S.C. § 103(a)

Claims 1-9 and 11 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Gurney et al. (US# 5,422,571; "Gurney") in view of either Fukuzawa et al. (US# 6,338,899; "Fukuzawa") or Gill (US# 6,219,208).

Gurney teaches a conventional spin-valve magnetoresistive sensor that includes a back layer comprising a single nonmagnetic metal layer (e.g., Cu) disposed adjacent the free-side ferromagnetic layer (e.g., Figure 6). Gurney specifically discloses a MR spin valve sensor structure that includes a Cu back layer having a thickness of 20Å covered with a 30Å layer of Ta. (Column 7, lines 30-35; Figure 6)

Gurney, however, fails to teach or suggest a MR spin valve sensor structure that includes "an electron-reflective layer disposed adjacent to the non-magnetic back layer on a side of the non-magnetic back layer opposite the free ferromagnetic layer" as recited, for example, in amended claim 1. That is, Gurney fails to teach or suggest a sensor structure that includes an oxide layer, or large band gap

semiconductor material, disposed adjacent the non-magnetic back layer which functions as an electron-reflective layer.

The Office Action states that either Fukuzawa or Gill teach electron reflective layers and that a person of ordinary skill in the art at the time the invention was made would have been motivated to combine the electron reflective layers taught by either Fukuzawa or Gill into the MR spin valve sensor structure of Gurney to arrive at Applicant's claimed invention. Applicant respectfully disagrees for the reasons given below.

Fukuzawa teaches a MR device with "a reflective film on one or both sides of the basic unit of the GMR film of magnetic layer/nonmagnetic spacer layer/ magnetic layer structure, so that electrons are elastically reflected on the reflective film to thereby prolong the mean free path of electrons in the basic unit of the GMR film." (Col. 60, lines 25-30) This passage demonstrates that Fukuzawa discloses no more than the conventional back layer structure of Gurney. That is, Fukuzawa fails to disclose or suggest a MR device structure that includes a free magnetic layer/non-magnetic back layer/electron-reflective layer structure. Put differently, Fukuzawa fails to teach a MR device structure that includes *both* a non-magnetic back layer *and* an electron-reflective layer disposed adjacent one another.

Moreover, Fukuzawa teaches away from the claimed invention when he disparages the use of a Ta film as a protective layer laminated on the surface of a metal back layer (e.g., a Au film). As Fukuzawa clearly states, when Ta is utilized as a film adjoining a Au metallic back layer, "[T]he Au film loses its mirror reflectivity... and are therefore not practicable." (Col. 61, line 65 through col. 62, line 5)

Regarding the Examiner's reference to column 64, lines 50-64 of Fukuzawa, this passage merely refers to a nonmagnetic *underlayer* 5 formed between magnetic layer 1 and non-magnetic spacer layer 3. Such a structure is not claimed by Applicant. Apparently the examiner considers that the underlayer 5 of Fukuzawa is

equivalent to Applicant's claimed back layer. Fukuzawa's underlayer 5 is not equivalent to applicant's claimed back layer. Rather, Fukuzawa's underlayer 5 is analogous to underlayers 2 & 3 shown in Applicant's Figure 1, but it certainly does not consist of or function as the back layer of the claimed invention.

There simply is no teaching in Fukuzawa of a spin valve MR sensor structure that includes a non-magnetic back layer disposed adjacent the free layer on a side of the free magnetic layer opposite the non-magnetic spacer layer, *and* an electron-reflective layer disposed adjacent the non-magnetic back layer on a side of the back layer opposite the free magnetic spacer layer. Indeed, given Fukuzawa's disparaging remarks about the use of a Ta layer adjoining a metallic back layer, Applicant respectfully submits that one of ordinary skill in the art would have definitely been discouraged from attempting to build a MR device according to the claimed invention, wherein, according to one embodiment, a Ta layer is formed on a metal back layer, and then oxidized.

Applicant further notes that the discussion in column 72, lines 21-26 of Fukuzawa refers to the properties and characteristics of a metal/metal interface, which does not pertain to the claimed invention.

Because neither Fukuzawa nor Gurney teach or suggest a MR sensor structure that includes "an electron-reflective layer disposed adjacent to the non-magnetic back layer on a side of the non-magnetic back layer opposite the free ferromagnetic layer", a person of ordinary skill would have had to arrive at the claimed spin-valve magnetoresistance sensor without any guidance, teaching, or suggestion whatsoever. In other words, the combination of Fukuzawa and Gurney would not have lead one of ordinary skill to Applicant's claimed invention because neither reference discloses or suggests a spin-valve MR sensor structure comprising an electron-reflective layer disposed adjacent to the non-magnetic back layer on a side of the non-magnetic back layer opposite a free ferromagnetic layer.

Gill teaches a dual spin valve sensor that has a free layer structure 202 disposed between pinned layer 208 and a self-pinned layer 210, with spacer layers 206 and 204 separating the free layer structure 202 from the respective pinned layers 208 & 210 (see Figure 12; col. 6, lines 18-36; col. 7, lines 10-20). A dual spin valve sensor structure is characterized by a pinned magnetic layer 208 disposed adjacent to an antiferromagnetic layer 212, and a second, self-pinned layer 210 disposed adjacent to and between a second non-magnetic spacer layer 204 and a specular reflector structure 222. (See Figure 12) Applicant does not teach or claim a dual spin valve MR sensor structure.

Gill's specular reflector structure consists of first and second metal layers 226 & 228 interfacing the self-pinned layer 210. As shown in Figure 12, Gill discloses a structure in which a nonmagnetic conductive first spacer layer 208 is located between the first AP pinned layer structure 204 and the triple AP coupled free layer structure 202. A nonmagnetic conductive second spacer layer 210 is located between the AP pinned layer structure 206 and the triple AP coupled free layer structure 202. (Col. 7, lines 54-63.) Specular reflector structure 222 is formed on top of an underlayer, referred to as nanolayer 232, which covers Al_2O_3 substrate 238.

The Office Action states that Gill teaches metal oxides for a reflective layer, pointing to the disclosure of NiMnO for underlayer 232. Applicant respectfully disagrees.

Gill is very specific about which layers make up his specular reflector structure 222: they are layers 226 & 228. Underlayer 232 is not part of Gill's reflector structure; rather, Gill teaches layer 232 as merely functioning as an underlayer that buffers the base of his dual spin-valve magnetoresistance sensor from substrate 238. Nowhere does Gill suggest that his underlayer 232 acts as an electron-reflective layer; nor is it apparent from any teaching that it would function as such.

The person of ordinary skill therefore would have had to depart from the teachings of Gurney and Gill and devise a completely alternative structure for a spin-valve magnetoresistance sensor. Gurney only teaches a conventional spin-valve MR sensor structure with a metal back layer. Gill, on the other hand, teaches a different type of sensor altogether: a dual spin-valve MR sensor with a metal reflector structure disposed on a conventional underlayer/substrate base. A person of ordinary skill considering these prior art references would find no teaching or suggestion – and therefore no reason – to attempt a single (not dual) spin-valve MR sensor structure that includes "an electron-reflective layer disposed adjacent to the non-magnetic back layer on a side of the non-magnetic back layer opposite the free ferromagnetic layer". Indeed, the combination of Gurney and Gill would certainly not have lead one of ordinary skill to Applicant's claimed invention because neither reference discloses or suggests Applicant's claimed structure.

Accordingly, Applicant respectfully requests that the rejection of claims 1-22 under 35 U.S.C. § 103(a) be withdrawn. Applicant respectfully submits that all pending claims are now in condition for allowance.

Please charge any shortages and credit any overcharges to our Deposit Account No. 50-2060.

Respectfully submitted,
BURGESS & BEREZNAK, LLP

Dated: 10/6/03, 2003

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FIRST CLASS CERTIFICATE OF MAILING
(37 C.F.R. § 1.8(a))

I hereby certify that the foregoing **AMENDMENT AND RESPONSE** is being deposited with the United States Postal Service as first class mail with sufficient postage in an envelope addressed to the M/S Petition, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on 10/6/03.

Caitlin Burgess
Name of Person Mailing Correspondence

Signature

10-6-03
Date